*Modes of Star Formation and the Origin of Field Populations*
*ASP Conference Series, Vol. XXXX, 2001*
*E. K. Grebel and W. Brandner, eds.*

# Stellar Associations and their Field East of LMC 4 in the Large Magellanic Cloud

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**Abstract.** We report about the stellar content and the luminosity and mass functions of three stellar associations and their field located on the north-east edge of the super-bubble LMC 4 in the Large Magellanic Cloud.

## 1. Introduction

OB stellar associations represent the younger stellar systems in a galaxy. The Large Magellanic Cloud (LMC) is characterised by a large number of such systems, as well as of giant and super-giant shells detected in HI. The edges of super-giant shells are in many cases the loci of recent star formation. In order to investigate the population of young stellar systems of the LMC, Gouliermis et al. (2000a) developed an objective technique for the detection of low concentrated young stellar groups. The detected systems are classified according to their stellar densities (in $M_\odot$ $pc^{-3}$) into three categories, namely 'unbound', 'intermediate' and 'bound' systems. It was found that the unbound systems are the stellar associations of the galaxy, while most of the intermediate ($\sim$ 70%) are probably stellar associations or open clusters.

The application of this method on a digitised 1.2m UK Schmidt Telescope Plate in the U band resulted in a Catalog of young stellar systems in the central ($6.^\circ5 \times 6.^\circ5$) region of the LMC (Gouliermis et al. 2000b). It was found that the systems show to be aligned in filamentary structures (or arcs). A comparison of this survey with the newly detected giant and super-giant shells by Kim et al. (1999) showed that some of these arcs are related to the edges of the

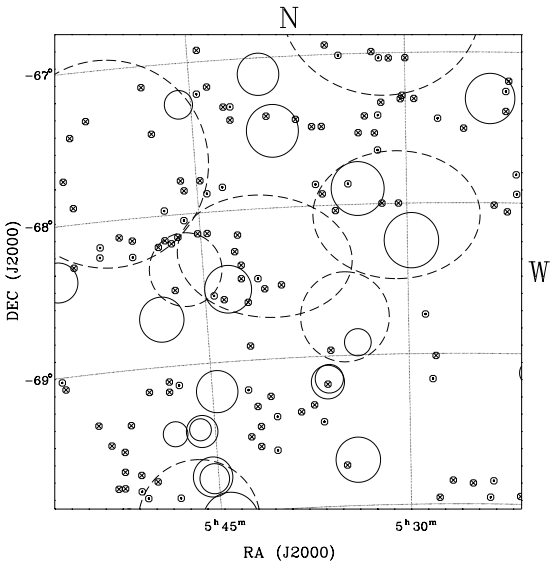


Figure 1. The NE part of the Survey of young stellar systems in the central area of the LMC by Gouliermis et al. (2000b). The $\odot$ symbols represent the loci of the detected 'unbound' stellar systems, while the $\otimes$ symbols represent the 'intermediate' ones. The areas of the giant (solid lines) and super-giant (dashed lines) shells as were identified by Kim et al. (1999) have been overplotted. Only a small portion of LMC 4 area, shown on the NW part of the figure, is covered by the survey.

shells (Figure 1). We report the results of an investigation of stellar associations located on the north-east edge of one of the most interesting super-giant shells in this galaxy, LMC 4.

## 2. Stellar Content of the Observed Systems and the Field

We performed $BVR$ photometry in an area of $20\farcm5 \times 20\farcm5$ to investigate the stellar content of three stellar associations: LH 91 & LH 95 (Lucke & Hodge 1970) and LH 91-I (Kontizas et al. 1994) and their field, situated to the east of LMC 4. Our observations include H$\alpha$ measurements to identify the Be population of the region. We found that Be stars exist in all the associations. In LH 95 we verified that the HII emission is strongly related to Be stars located in the very centre of the system. We estimated the reddening and the age of the systems based on isochrone fitting. The reddening was found to vary between $E(B-V) \simeq 0.15$ and 0.20 mag. All systems were found to be younger than 10 Myr, while the field is older than $\sim 80$ Myr. Both LH 91-I and LH 95 were identified as distinct stellar groups using star counts, while LH 91 does not show to represent any specific stellar concentration.

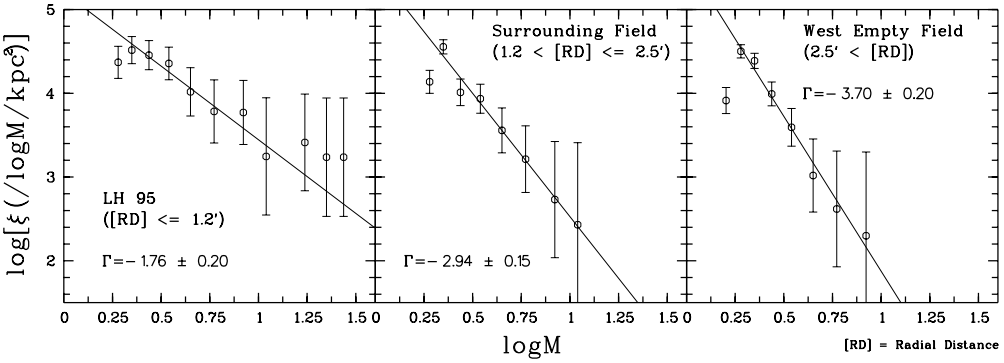


Figure 2. Radial gradient of the MF slope outwards the centre of LH 95, within 1.′2 (left), for radial distances $1.'2 < r < 2.'5$ (middle) and for a more distant empty area toward the west, where there is no contamination of stars from other systems (right).

### 2.1. Luminosity and Mass Functions

We constructed the luminosity functions (LFs) of the MS populations of the systems and the field using the $B$ magnitudes. The slopes $s$ of the completeness corrected and field subtracted LFs ($\log N \propto s \cdot B_{\rm bin}$) of LH 91-I and LH 95 were found to be around $0.16 \pm 0.06$, while the one of LH 91 is steeper and similar to the field's ($s \simeq 0.51 \pm 0.08$) for the same magnitude range of $16.5 \lesssim B \lesssim 19.5$ mag.

For the construction of the mass functions (MFs) we performed counts of stars in mass intervals. We corrected the counted numbers for incompleteness and we normalized them to a surface of 1 kpc$^2$. A Salpeter IMF corresponds to slope $\Gamma = -1.35$. It was found that the systems have MF slopes in the range between $\Gamma \simeq -1.6 \pm 0.3$ (field subtracted MF of LH 95) and $-2.2 \pm 0.4$ (LH 91), much more shallow than the MF slope of the field, which varies from $\Gamma = -3.7$ up to $-4.9$.

In Figure 2 the most interesting case of LH 95 is presented, where a radial dependence of the MF slope was observed, possibly an indication that stars escape from the system contributing to the enrichement of the field population. We verified that LH 95 is not an extended system (further than $\sim 1.'5$), and probably is being disrupted (Gouliermis et al. 2000c).

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